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DEVELOPMENT OBJECTIVES :

ADVANCED FILM-VIEWING LIGHT TABLE WITH TRANSLATING MICROSCOPE

CARRIAGE AND HIGH-INTENSITY TRACKING LIGHT SOURCES

1. INTRODUCTION.

These development objectives describe requirements to be met in the design and development of an advanced film-viewing light table with a translating microscope and integral, high-intensity, tracking light sources.

2. CONCEPT.

The proposed light table will improve viewing with translating stereo-microscopes or microstereoscopes. It incorporates features for ease of viewing and two high-intensity condenser-type light sources for the optimized narrow field illumination required for 30X-150X magnification viewing. These light sources shall incorporate an advanced tracking system to permit them to retain proper alignment with the microscope as the operator scans the film.

3. GENERAL DESCRIPTION.

This table shall provide an 11" by 40" illuminated area for use in viewing single rolls of 9½", 5" or 70mm film, or two rolls of either 5" or 70mm film. This unit will normally be positioned on an elevating or low, fixed table with the unit's viewing surface in a horizontal position, the long dimension extending to the right and left of the operator. The operator will work at the table as he would sit (or stand) at his own desk. Most operators prefer to position a viewer close to the edge of their side of the supporting table. A movable carriage shall afford translation of a microscope over the viewing area, while dual, independently adjustable, condenser-type light sources track the moving microscope.

4. REQUIREMENTS.

4.1. Illumination Systems.

4.1.1. General Illumination. To facilitate general viewing and small image location, the total 11" by 40" glass format shall be illuminated by fluorescent-type illumination.

4.1.1.1. Intensity Range. At full intensity, the general illumination system must provide at least 1000 foot-lamberts measured at the illumination surface. Illumination shall not vary by more than 10% between any two points on the entire illuminated surface.

4.1.1.2. Variability of Intensity. The intensity of illumination shall be continuously variable through a range of 15% - 100% of full intensity without visible evidence of "flicker".

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4.1.1.3. Heat. The general illumination source must be able to be operated continuously at maximum intensity over a 24-hour period, in a room with an 80°F ambient temperature, without exceeding 110°F on any external surface of the light table.

4.1.1.4. Diffuser. An opal glass or similar diffuser shall be located between the light source and the clear glass top.

4.1.1.5. Shades. Adjustable shades must be provided to mask out all of the viewing surface not actually covered by film. Each of these shades must be located beneath the surface glass, mounted along the long dimension of the unit and extendable across the short dimension. This extensibility must be continuously variable between a minimum extension of (0) zero inches and a maximum extension of 9 inches. These shades must not encroach upon the illuminated viewing area when retracted and, in addition, must be able to be locked in any extended or retracted position.

4.1.2. High-Intensity Illumination System.

4.1.2.1. General. Two high-intensity, condenser-type light sources shall be provided. They should be positioned between the general illumination light source and the surface glass plate.

4.1.2.2. Independent Adjustment. Each of the light sources shall be independently adjustable in the X and Y axes in such a manner that they can be positioned (1) beneath the separate objectives and/or rhomboids of a micro-stereoscope or (2) beneath the single objective of a stereomicroscope. These two condensers must be capable of a minimum separation between them of 50mm, from center to center: 40 mm is a design goal.

4.1.2.3. Independent Adjustment Control. Controls must be provided for regulating the independent adjustments. These may be mechanical (hand wheels), electrical or electro-mechanical devices. If electrical or electro-mechanical, they must provide the same degree of control sensitivity as hand wheels or knobs.

4.1.2.4. Common Tracking Motion. Once the initial, independent adjustment to align the condensers with the objective lenses or rhomboids has been made, the light sources shall be locked in common synchronized motion. Thus, when the microscope and microscope carriage are translated, the two high-intensity sources will track the carriage while retaining their previous alignment with the microscope's objective (or objectives). These condensers must track throughout the total scan range of the microscope.

4.1.2.5. Intensity Range. At full intensity, the high-intensity sources must provide adequate illumination of a film area with an average density of 2 units as viewed through the optical system of a [redacted] stereoscopic microscope (with rhomboids), operating at a magnification of 100X. All other magnification settings of this and the other two instruments (paragraph 4.5.3.) shall be equally well-illuminated. These sources shall operate at a color temperature between 3500° - 5500°K.

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4.1.2.6. Variability of Intensity. Means shall be provided for continuously varying illumination from 50% - 100% of full intensity on each independent high-intensity source. Such reduction shall not reduce Kelvin temperature below 3500°K. On and off switches must be provided for each high-intensity source.

4.1.2.7. Heat. Temperature of the film (average density of two units) shall not exceed 100°F above ambient after being stationary for 30 minutes in the high-intensity light path under maximum illumination. The temperature of the light table's outside skin (including the top glass plate) shall not exceed 50°F above ambient when continuously operated for an eight-hour period, with film (2.0 density) on the table and with both condenser and general illumination operating at maximum intensity.

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4.2. External Configuration.

4.2.1. Size. The entire unit shall not exceed 55" in length and 21" in width. Width is exclusive of the crank handles but includes all the components of the translating carriage. The overall height of the light table shall not exceed 7" (minus the carriage, scope and reels.) The carriage height shall be kept at a minimum.

4.2.2. Weight. The unit must be as light as possible without sacrificing good stability.

4.2.3. Height adjustment. A superior adjustment system must be provided so that the entire table can be raised or lowered 3".

4.2.4. Tilt Mechanism. A means must be provided for a 0° through 15° back-to-front tilt of the light table about its long axis. This motion must be simple, smooth, positive and must be able to be locked at any angular tilt within this range.

4.2.5. Comfortable Viewing Position. The light table, the translating carriage and the microscope adapter mounts must be designed to place each of the microscopes at a comfortable viewing height and in a comfortable working position. Human engineering factors should count strongly in the new design. It is understood, of course, that these positions also depend on the height of the illuminated surface, the requirement for the carriage to adequately clear the film and the varying working distances of the microscopes.

4.3. Spool Loading and Holding Mechanism.

4.3.1. Loading Mechanism. A means for the fast loading and unloading of single spools of 9½", 5" and 70mm film or two rolls of either 5" or 70mm must be provided. Rolls will range up to, and including, 500-feet capacity. This loading system must operate quickly and at the same time be positive in action: i.e., it must not drop the heaviest full spool (9½", 500 feet) no matter how fast or hard the film is cranked. A drop-in film loading system is desirable.

4.3.2. Holding Mechanism. The holding mechanism which engages and secures the spool must be designed for easy one-hand operation -- so that the film can be held in one hand while the holding mechanism is activated with the other. A positive but quick release lock must be incorporated.

4.4. Film Transport.

4.4.1. General. A unique film transport system shall permit bi-directional film motion controllable from either end: i.e., it will permit both winding and unwinding with the same crank at one end of the table. This transport system may be either mechanical or electro-mechanical; however, basic simplicity of design and complete reliability are mandatory. Consequently, a purely mechanical system is more desirable.

4.4.2. Film Capacity. The film transport system must accommodate either single rolls of 9½"-, 5"- or 70mm-wide film on either partially- or fully-loaded spools of up to, and including, 500-feet capacity. In addition, provision must be made for handling two rolls of either 5" or 70mm film simultaneously. These rolls should be mounted side by side with a supporting post in between.

4.4.3. Film Direction. Film spools shall be located at both ends of the long dimension of the viewing area, with the film or films transported along (and parallel to) the long axis of the light table. When two rolls are used, the film strips will travel parallel to each other and to the long axis of the table, with a minimum separation between strips.

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4.4.4. Rollers. Rollers must be designed so that film can be transported either emulsion-up or emulsion-down without scratching. Either the rollers must be segmented or some alternative system provided so that when two rolls of film are used, the alternate rolls can be wound in opposite directions concurrently or one of the two rolls translated while the other roll remains stationary.

4.4.5. Film Tension. The film transport mechanism must maintain a light, constant, even tension on the film or films -- just enough to keep the film flat and in contact with the plate glass surface when the film is stationary. This tension should be automatically reduced or eased when the film is moved.

4.4.6. Film Drive.

4.4.6.1. Drive Modes. The film drive must: wind and unwind single rolls of $9\frac{1}{2}$"-, 5"- or 70mm-wide film or two rolls of either 5" or 70mm film; be capable of winding one of the dual rolls while unwinding the alternate roll and/or permit one roll to remain stationary while the other roll is translated.

4.4.6.2. Drive Control. The drive control may be a hand-crank or electrical switch; however, if an electrical control is used, it <u>must provide the same degree of control sensitivity as a hand-crank</u>.

4.4.6.3. Dual Speed Range. A dual speed range with a high or "slew" speed shall be provided. This could be in the form of a two-speed, mechanical gear shift, a two-speed electrical motor, a variable lever arm crank or an electro-mechanical approach.

4.4.6.4. Reliability and Efficiency. Whatever the system, it must be very reliable. Each individual hand crank must wind or unwind film very smoothly -- from either its own spool or the spool at the other end of the table. The drive must be a low-friction system which incorporates inertia damping and antibacklash features. The efficiency, reliability and ease of operation of this drive system is one of the most important considerations in this development.

4.5. <u>Translating Microscope Carriage</u>.

4.5.1. General. A carriage shall be provided for translating a stereo-microscope or microstereoscope in both X and Y directions over the illuminated format.

4.5.2. Amount of Translation. The optical center of the microscope shall scan an area of 10" by 35". This area shall be centered in the illuminated area, across the short dimension, and shall commence one-half inch from the right-hand edge of the illuminated area. (The right-hand edge refers to the operator's right as he faces the light table.)

4.5.3. Adapters must be provided for mounting three separate microscopes:

STAT [redacted] They must permit a rapid but stable mounting of any of the above units (with their attendent focusing mechanisms) upon the translating carriage. In addition, this mounting must permit an 180° rotation of each scope so that it may be used parallel to either the X- or Y-axis of the light table and from either long side.

4.5.3.1. Carriage Motion. The carriage motion must be a smooth, positive, low-friction motion which is free of vibration ("chatter"). The friction load must be consistent throughout its range: i.e., a consistent pressure results in a consistent motion with no position of lesser or greater resistance.

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4.5.3.2. Locks. Positive locks must be provided to lock the carriage in X and Y at any position of its 10" by 36" travel.

4.5.3.3. Fine Micrometer Motion. A fine micrometer X- and Y-microscope motion must be provided. The total travel of this motion must be ±2cm. in both X and Y. This motion shall be a precision, auxiliary motion accomplished once the main translational carriages have been locked in position. This precision motion must be graduated and easily readable. The motion shall be accurate to .001mm plus .01% of the total distance being measured with a least count of .0005mm.

alternate motion, fine or coarse measurement

4.5.3.4. Rigidity. It is mandatory that the carriage ways be of rigid construction to insure perpendicularity of the X and Y axes. These ways (or tracks) must be perpendicular and parallel to the extent that, when one end of the Y track is locked (so that it can not move in X) and a pressure of 5 pounds is applied to the other end (longest possible lever arm) of the Y track, it will not deflect more than .002".

4.6. Miscellaneous.

4.6.1. Construction. Construction shall meet the highest commercial standards.

4.6.2. Shock Hazard. The unit must be grounded and free of all shock hazards.

4.6.3. Warning Light. A warning light must be provided to show when the unit is on even if the (table) light intensity is turned completely down.

4.6.4. Controls. All operational controls must be conveniently located and readily accessible to the operator. Human engineering factors must be thoroughly considered in the design and placement of these controls.

Contractor must provide use at his plant of all test instruments to satisfactorily determine if the design requirements are met.

8/24/65: Contractors complaining?